

Table 12. Pesticides Summary

BMU1: PESTICIDES SUMMARY						
		ALACHOR	ATRAZINE	CYANAZINE <sup>1,2,3</sup>	METOLACHLOR <sup>1</sup>	SIMAZINE <sup>2,4</sup>
NUMBER OF SAMPLES	TOTAL:	563	563	522	563	526
BY REGION:	BLUEGRASS (INNER & OUTER):	350	350	322	350	325
	EASTERN COAL FIELD:	135	135	130	135	130
	MISSISSIPPIAN PLATEAU:	74	74	66	74	67
	OHIO RIVER ALLUVIUM:	4	4	4	4	4
NUMBER OF DETECTIONS	TOTAL:	2	94	0	16	16
	% DETECTS (vs SAMPLES):	0.4%	16.7%	0.0%	2.8%	3.0%
BY REGION:	BLUEGRASS (INNER & OUTER):	2	91	0	15	15
	EASTERN COAL FIELD:	0	0	0	1	1
	MISSISSIPPIAN PLATEAU:	0	3	0	0	0
	OHIO RIVER ALLUVIUM:	0	0	0	0	0
NUMBER OF DETECTIONS ABOVE STANDARD	TOTAL:	0	0	0	0	0
	% DETECTIONS > STANDARD (of SAMPLES w/DETECTIONS):	0.0%	0.0%	0.0%	0.0%	0.0%
	% SAMPLES > STANDARD (of TOTAL SAMPLES):	0.0%	0.0%	0.0%	0.0%	0.0%
BY REGION:	BLUEGRASS (INNER & OUTER):	0	0	0	0	0
	EASTERN COAL FIELD:	0	0	0	0	0
	MISSISSIPPIAN PLATEAU:	0	0	0	0	0
	OHIO RIVER ALLUVIUM:	0	0	0	0	0
NUMBER OF SITES <sup>3</sup>	TOTAL:	57	57	56	57	56
BY REGION:	BLUEGRASS (INNER & OUTER):	33	33	32	33	32
	EASTERN COAL FIELD:	19	19	19	19	19
	MISSISSIPPIAN PLATEAU:	4	4	4	4	4
	OHIO RIVER ALLUVIUM:	1	1	1	1	1
NUMBER OF SITES WITH DETECTIONS	TOTAL:	2	14	0	5	7
	% SITES W/DETECTIONS:	3.5%	24.6%	0.0%	8.8%	12.5%
BY REGION:	BLUEGRASS (INNER & OUTER):	2	13	0	4	6
	EASTERN COAL FIELD:	0	0	0	1	1
	MISSISSIPPIAN PLATEAU:	0	1	0	0	0
	OHIO RIVER ALLUVIUM:	0	0	0	0	0
NUMBER OF SITES WITH DETECTIONS ABOVE STANDARD	TOTAL:	0	0	0	0	0
	%SITES w/DETECTIONS>STANDARD (of SITES w/DETECTIONS):	0.0%	0.0%	0.0%	0.0%	0.0%
	%SITES w/DETECTIONS>STANDARD (of TOTAL SITES):	0.0%	0.0%	0.0%	0.0%	0.0%
BY REGION:	BLUEGRASS (INNER & OUTER):	0	0	0	0	0
	EASTERN COAL FIELD:	0	0	0	0	0
	MISSISSIPPIAN PLATEAU:	0	0	0	0	0
	OHIO RIVER ALLUVIUM:	0	0	0	0	0
ALACHLOR	MCL (mg/L)	0.002	HAL (mg/L)	Other		
ATRAZINE	0.003	-	-	-		
CYANAZINE	-	0.001	-	-		
METOLACHLOR	-	0.100	-	-		
SIMAZINE	0.004	-	-	-		

<sup>1</sup>HAL used in absence of MCL

<sup>2</sup>9000-1103 Shane's Spring - no analyses for cyanazine or

<sup>3</sup>Only 522 cyanazine values out of 565 samples:  
 4 analyses: samples prior to May 97 not analyzed for cyanazine,  
 34 analyses: KGS samples Aug 1996 - Apr 1997 analyzed for "triazines" - no separate results for cyanazine,  
 4 analyses: no N/P Pesticides included in lab analyses,  
 1 analysis: lab analysis for metals only.

<sup>4</sup>Only 526 simazine values out of 565 samples:  
 34 analyses: KGS samples Aug 1996 - Apr 1997 analyzed for "triazines" - no separate results for simazine,  
 4 analyses: no N/P Pesticides included in analyses,  
 1 analysis: lab analysis for metals only.

Table 13. Pesticides Descriptive Statistics

BMU1: PESTICIDES DESCRIPTIVE STATISTICS						
	ALACHLOR (mg/L)					
	START DATE	END DATE	MAX	MEDIAN	MIN	MODE
TOTAL:	04/26/95	06/11/03	< 0.00006	< 0.00004	< 0.00002	< 0.00004
BLUEGRASS (INNER & OUTER):	04/26/95	06/11/03	< 0.00006	< 0.00004	< 0.00002	< 0.00004
EASTERN COAL FIELD:	05/02/95	05/28/03	< 0.00006	< 0.00004	< 0.00002	< 0.00004
MISSISSIPPIAN PLATEAU:	04/27/95	06/11/03	< 0.00006	< 0.00004	< 0.00002	< 0.00004
OHIO RIVER ALLUVIUM:	04/21/99	03/07/00	< 0.00004	< 0.00004	< 0.00004	< 0.00004
	ATRAZINE (mg/L)					
	START DATE	END DATE	MAX	MEDIAN	MIN	MODE
TOTAL:	04/26/95	06/11/03	0.00041	< 0.00005	0.000007	< 0.00004
BLUEGRASS (INNER & OUTER):	04/26/95	06/11/03	0.00041	< 0.00005	0.000007	< 0.00004
EASTERN COAL FIELD:	05/02/95	05/28/03	< 0.0003	< 0.00005	< 0.00004	< 0.00004
MISSISSIPPIAN PLATEAU:	04/27/95	06/11/03	< 0.0003	< 0.00005	< 0.00004	< 0.00004
OHIO RIVER ALLUVIUM:	04/21/99	03/07/00	< 0.00004	< 0.00004	< 0.00004	< 0.00004
	CYANAZINE (mg/L)					
	START DATE	END DATE	MAX	MEDIAN	MIN	MODE
TOTAL:	04/26/95	06/11/03	< 0.0001	< 0.00004	< 0.00004	< 0.00004
BLUEGRASS (INNER & OUTER):	04/26/95	06/11/03	< 0.0001	< 0.00004	< 0.00004	< 0.00004
EASTERN COAL FIELD:	05/02/95	05/28/03	< 0.0001	< 0.000049	< 0.00004	< 0.00004
MISSISSIPPIAN PLATEAU:	04/27/95	06/11/03	< 0.0001	< 0.00005	< 0.00004	< 0.00004
OHIO RIVER ALLUVIUM:	04/21/99	03/07/00	< 0.00004	< 0.00004	< 0.00004	< 0.00004
	METOLACHLOR (mg/L)					
	START DATE	END DATE	MAX	MEDIAN	MIN	MODE
TOTAL:	04/26/95	06/11/03	0.00024	< 0.000049	< 0.00004	< 0.00004
BLUEGRASS (INNER & OUTER):	04/26/95	06/11/03	0.00024	< 0.00004	< 0.00004	< 0.00004
EASTERN COAL FIELD:	05/02/95	05/28/03	< 0.0002	< 0.00005	< 0.00004	< 0.00004
MISSISSIPPIAN PLATEAU:	04/27/95	06/11/03	< 0.0002	< 0.00005	< 0.00004	< 0.00004
OHIO RIVER ALLUVIUM:	04/21/99	03/07/00	< 0.00004	< 0.00004	< 0.00004	< 0.00004
	SIMAZINE (mg/L)					
	START DATE	END DATE	MAX	MEDIAN	MIN	MODE
TOTAL:	04/26/95	06/11/03	< 0.0003	< 0.00004	0.00001	< 0.00004
BLUEGRASS (INNER & OUTER):	04/26/95	06/11/03	< 0.0003	< 0.00004	0.000028	< 0.00004
EASTERN COAL FIELD:	05/02/95	05/28/03	< 0.0003	< 0.000048	0.00001	< 0.00004
MISSISSIPPIAN PLATEAU:	04/27/95	06/11/03	< 0.0003	< 0.00005	< 0.00004	< 0.00004
OHIO RIVER ALLUVIUM:	04/21/99	03/07/00	< 0.00004	< 0.00004	< 0.00004	< 0.00004

Table 14. Pesticide Method Detection Limits

Pesticide	Method Detection Limit Used for Samples, mg/L
Atrazine	0.0003, 0.00004, 0.00005
Metolachlor	0.00002, 0.00004, 0.00005, 0.00006, 0.00008
Cyanazine	No detects at any MDL; 0.00004 most frequent MDL
Simazine	0.0003, 0.00004, 0.00005
Alachlor	0.00002, 0.00004, 0.00005, 0.00006

Atrazine (most commonly sold under the trade name AAtrex or simply Atrazine) is used primarily for weed control for corn and soybean production and is one of the most commonly used herbicides in Kentucky. In 1999, when this study began, approximately two million pounds of atrazine were sold in Kentucky (KDA, 2000). Atrazine, with an MCL of 0.003 mg/L, is carcinogenic and exposure to excess amounts is associated with weight loss, cardiovascular damage and degeneration of muscle tissue and the retina. Atrazine has also recently been suspected to cause hermaphroditism in frogs (Hayes and others, 2002). Atrazine desethyl, a degradation by-product of atrazine, was also analyzed in this study. However, because no MCL has been established for atrazine desethyl, and because it is probably appropriate to evaluate atrazine and its chlorinated metabolites via additive analysis, only data for combined atrazine/atrazine desethyl is presented in this report. For simplicity, this is referred to as “atrazine” in this report.

Atrazine was the most detected herbicide in this study. Atrazine was analyzed in 563 samples and detected in 94, or 16.7% (Tables 12 and 13). As shown in Figure 36, atrazine occurred at 13 sites in the Bluegrass and one in the Mississippian Plateau. The median value for atrazine was less than 0.00004 mg/L, and nothing exceeded the MCL (Table 13). As expected, groundwater in agricultural areas with high row-crop production is most likely impacted by atrazine, and forests and residential areas are relatively unlikely to be affected.

Although no MCL exceedances for atrazine were found in this study, this compound does occur in groundwater from anthropogenic sources and is therefore a nonpoint source pollutant of concern. Ideally, this compound should be non-detect in groundwater. Monitoring for atrazine and its chlorinated degradation by-products should continue, as well as research into its effects upon the environment and human health.

# BMU 1 Median Atrazine Data

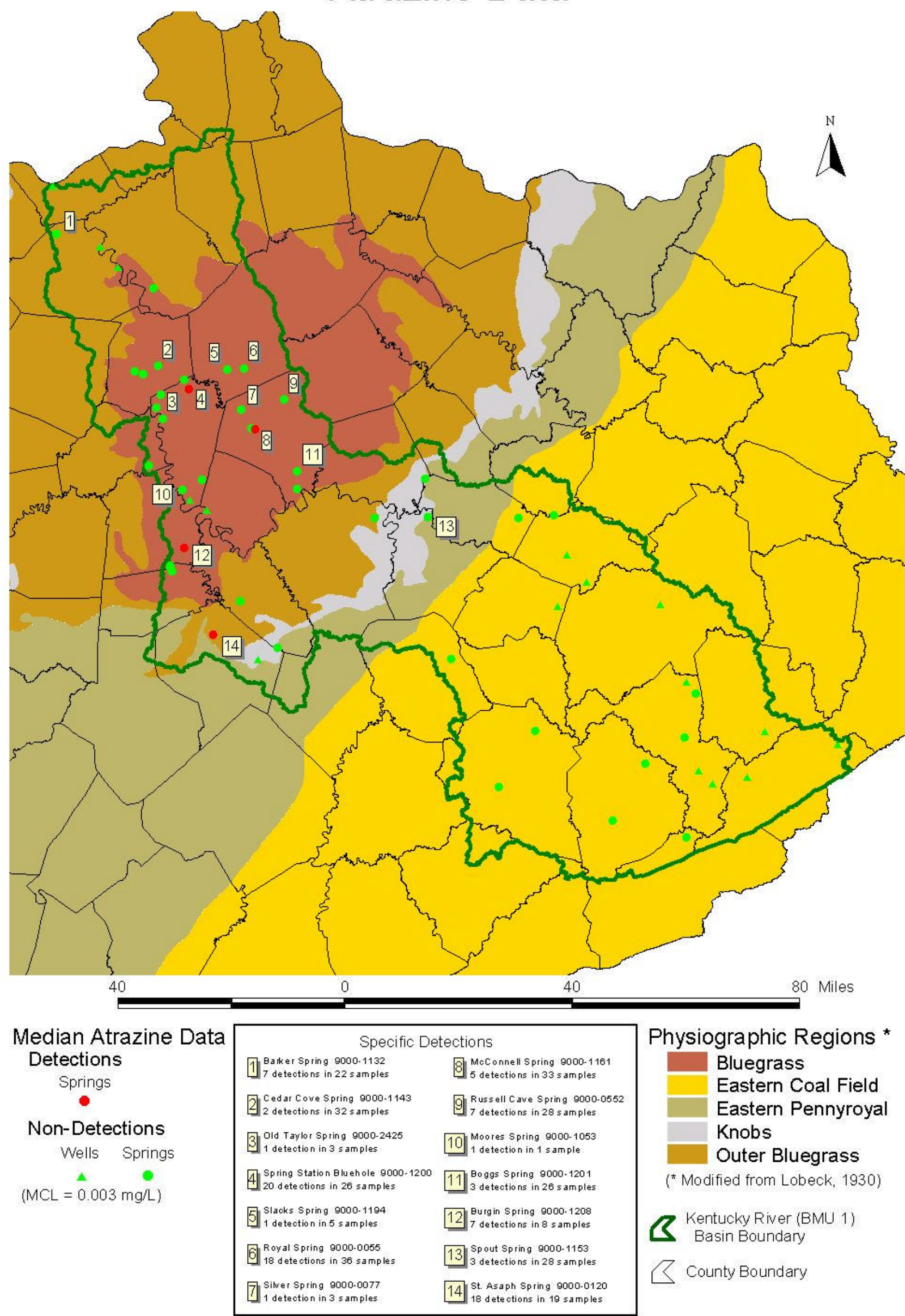


Figure 36. Atrazine Map

Metolachlor (trade names include Bicep II Magnum and Dual II Magnum) is used as a pre-emergent and pre-plant weed control for the production of corn and soybeans. In 1999 (KDA, 2000), approximately 800,000 pounds of metolachlor (combined metolachlor and s-metolachlor) were sold in the state. Metolachlor has an HAL of 0.10 mg/L, and is possibly carcinogenic in humans.

As shown in Tables 12 & 13, metolachlor was found in 2.8 % of the samples analyzed (16 of 563), and the median for BMU 1 was less than 0.000049 mg/L, but nothing exceeding the HAL was found. This herbicide occurred at four sites in the Bluegrass and one in the Mississippian Plateau (Figure 37).

Although the number of detections does indicate that metolachlor is a nonpoint source pollutant, the low levels found in this study suggests that its impacts to groundwater quality are minimal.

Simazine (trade names include Princep) is used to control annual nuisance grasses and broadleaf weeds, especially for corn and alfalfa production. In humans, simazine is carcinogenic and exposure to simazine is associated with tremors, damage to liver, testes, kidneys and thyroid and gene mutation. Simazine has an MCL of 0.004 mg/L.

Simazine was analyzed in 526 samples (Table 12), and found in 16, or 3.0%. Median values for BMU 1 were less than 0.00004 mg/L, and no MCL exceedances were noted (Table 13). Seven sites, as shown in Figure 39, had detections of simazine. As with metolachlor, simazine is a nonpoint source pollutant; however, its effects upon the environment appear to be minimal at this time.

Alachlor (trade names include Bullet and Micro-Tech) is used for corn and soybean production for pre-emergent weed control. Alachlor has an MCL of 0.002 mg/L. Alachlor has been associated with cancer in humans and has been linked with noncancerous effects in the liver, spleen and kidneys.



# BMU 1 Median Metolachlor Data

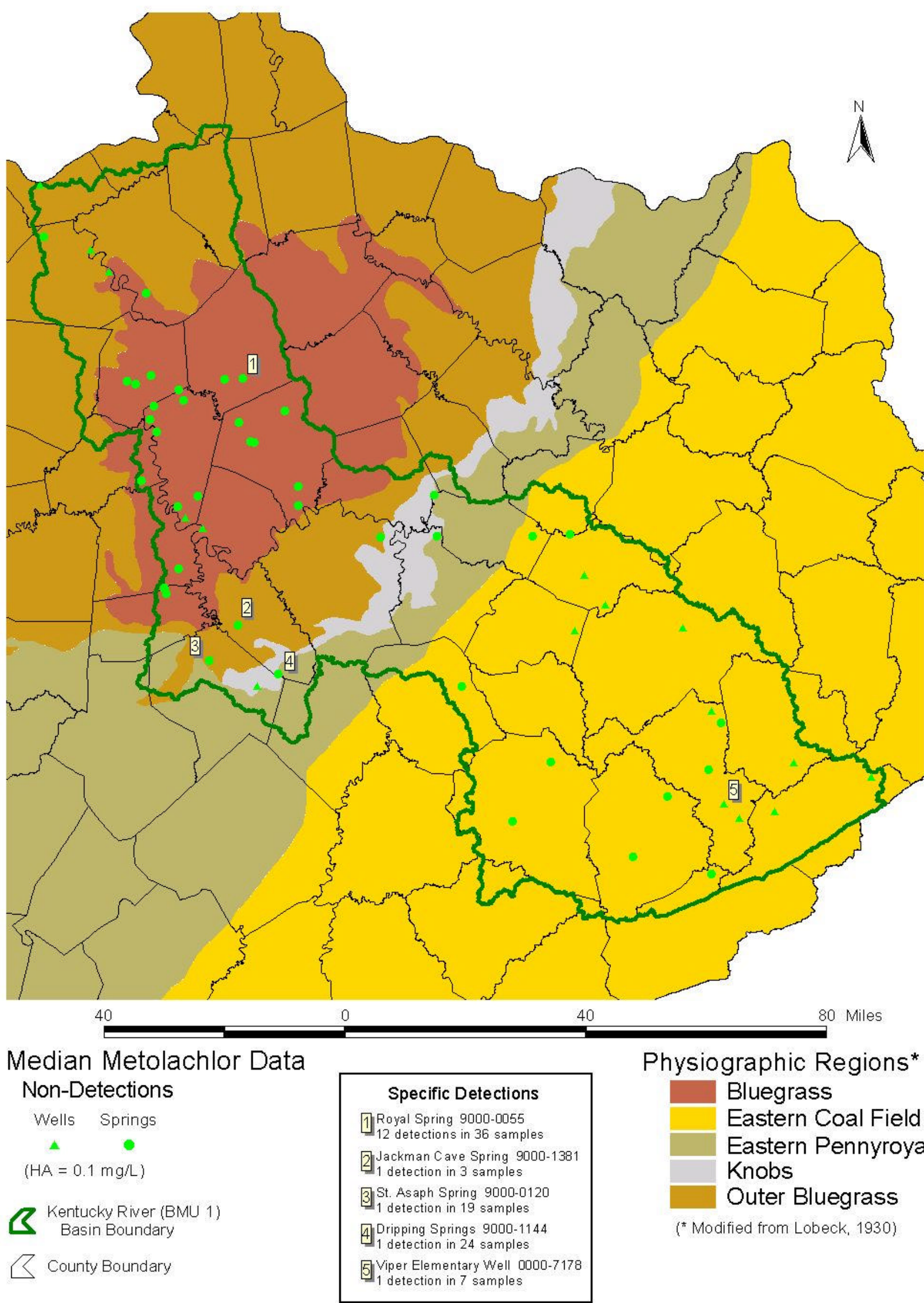


Figure 37. Metolachlor Map



# BMU 1 Median Simazine Data

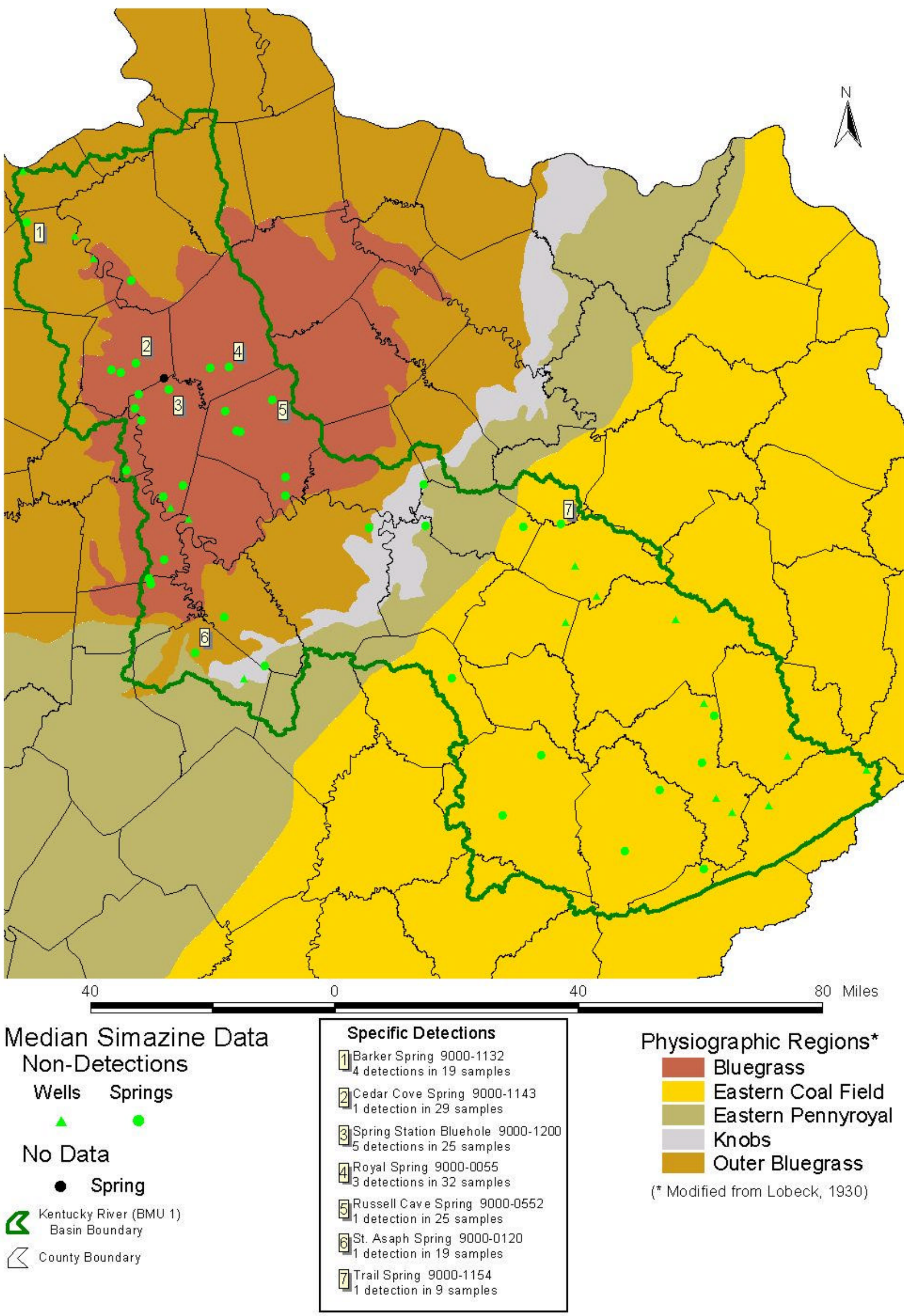


Figure 38. Simazine Map